

## Doppler Wind Lidar Measurements and Scalability to Space

Completed Technology Project (2017 - 2018)



## Project Introduction

Global measurements of wind speed and direction from Doppler wind lidars, if available, would significantly improve forecasting of severe weather events such as hurricanes, severe thunderstorms, volcanic plume transport, and smoke from wildfires. Doppler wind lidar have been successfully demonstrated on the ground and on aircraft, but the scanning telescopes traditionally used for Doppler wind lidars are too large and complex for operation in space.

The Airborne Cloud-Aerosol Transport System (ACATS) is a high spectral resolution lidar (HSRL) and Doppler wind lidar instrument managed at GSFC that flies on the high-altitude NASA ER-2 aircraft. ACATS is one of only two airborne Doppler wind lidar instruments developed and maintained at GSFC, and it is the only one that provides simultaneous measurements of cloud/aerosol properties and wind speed/direction within these layers. The performance of both wind and HSRL measurements was impeded by poor instrument calibration during previous flights. Previous work has resulted in improved instrument calibration and extinction measurements within cloud and aerosols layers. This project will enable testing and modifications to the receiver subsystem and/or instrument software to improve the quality of wind measurements from ACATS, and will also support the exploration of a new innovative telescope design that is scalable to space.

The objectives of this project are as follows:

1. Determine how ACATS calibration improvements have impacted the accuracy of the wind measurements.
2. Improve the quality of wind measurements from ACATS by modifying the receiver subsystem and/or instrument software.
3. Ensure the ACATS instrument is ready for future flights on the ER-2 aircraft.
4. Develop an innovative telescope concept for a space-based wind lidar mission.

The overall goal of this project is to demonstrate ACATS wind measurements and design an innovative telescope that can inform the development of a future satellite Doppler wind lidar mission. The tasks that will be completed to achieve the goals of this project are as follows:

1. Test ACATS line-of-sight (LOS) wind measurements from the ground at GSFC and compare to nearby radiosonde data to determine accuracy with the new calibration technique.
2. Modify the ACATS receiver subsystem and instrument software as necessary to further improve the accuracy of wind measurements.
3. Work with external "think-tank" engineers to explore an innovative telescope concept for a space-based wind lidar mission.

These tasks will ensure that this proposal's overall goals of readying ACATS for future field campaigns and demonstrating its scalability to space are met.



Project Lead with ACATS instrument during lab testing at NASA GSFC.

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## Doppler Wind Lidar Measurements and Scalability to Space

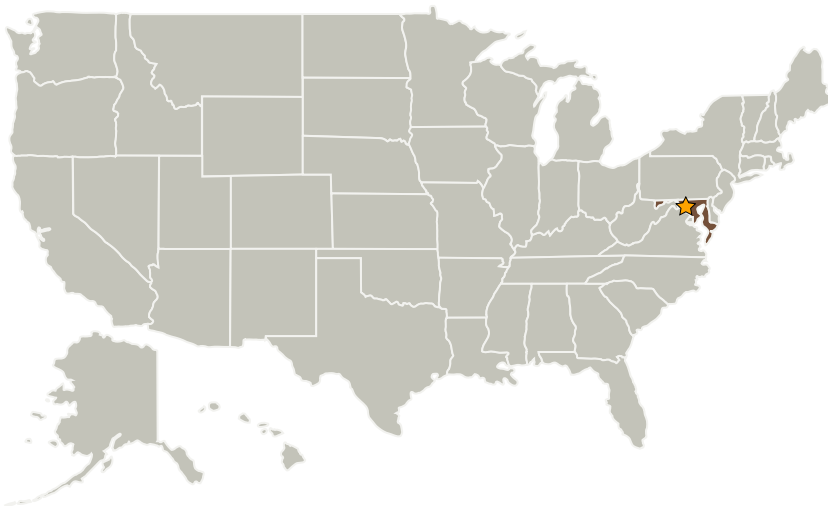
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## Anticipated Benefits

The ACATS instrument, once this work is complete, can participate in future aircraft field campaigns that contribute to NASA's Climate, Atmospheric Composition, and Weather Earth Science Focus Areas. In addition, the technology development in this project can inform future NASA space-based wind mission development in regards to lidar technology capabilities.

## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Goddard Space Flight Center (GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

## Primary U.S. Work Locations

Maryland

## Organizational Responsibility

## Responsible Mission Directorate:

Mission Support Directorate (MSD)

## Lead Center / Facility:

Goddard Space Flight Center (GSFC)

## Responsible Program:

Center Independent Research &amp; Development: GSFC IRAD

## Project Management

## Program Manager:

Peter M Hughes

## Project Managers:

Matthew J McGill  
William E Cutlip

## Principal Investigator:

John Yorks

## Co-Investigator:

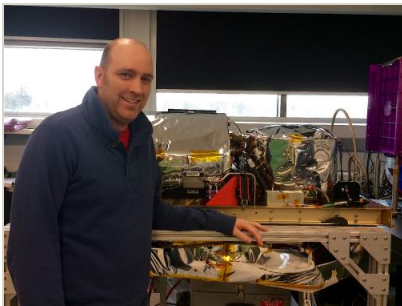
Vibart S Scott

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## Images



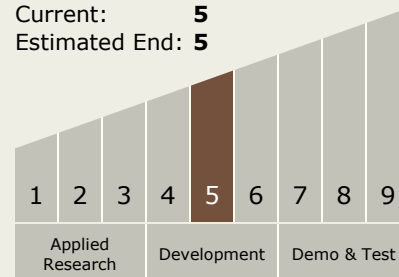
### ACATS Instrument

Project Lead with ACATS instrument during lab testing at NASA GSFC.

(<https://techport.nasa.gov/image/28277>)

## Technology Maturity (TRL)

Start: 5  
Current: 5  
Estimated End: 5



## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
    - └ TX08.1.5 Lasers

## Target Destination

Earth

## Supported Mission Type

Projected Mission (Pull)